TELESCOPIC NUT

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STATEMENT RELATING TO FEDERAL SUPPORT

This invention was made without the use of any government resources.

FIELD OF THE INVENTION

This invention relates to fastener and fastener systems or the like used to secure two generally planar surfaces together, and particularly to a fastener assembly wherein an inner member contacts a thread/shank interface and allows an outer fastener member to continue past the thread/shank interface and contact one of the planar surfaces.

BACKGROUND OF THE INVENTION

The subject matter to which this invention pertains is in the field of fasteners. Bolts and screws are used in a wide variety of aerospace and aircraft applications to secure and attach components that feature at least one coplanar surface. In these applications, it is generally desirable to apply a pre-determined torque to a bolt, whereby a state of tension exists in the bolt and a state of compression exists in the fastened members. The typical bolt may feature a length of threads starting from the end opposite the head of the bolt and extending along the shaft of the bolt, the threads terminating at the shank of the bolt. The length of the shank, or smooth unthreaded portion of the shaft

of the bolt between the threads and the head of the bolt, is defined as the grip length, or grip, in design vernacular. The shank is also typically where the maximum shear strength of the bolt is developed because of the larger, uninterrupted net section area in this region, as opposed to the broken surface of the threaded portion. Consequently, it is undesirable to place the threads of the bolt in the shear plane between two fastened surfaces because of the reduced strength of the bolt in the threaded region. Therefore, ensuring that the bolt shank is located and passes through the shear plane of any fastened members attains significant advantage. In addition, where the thread/shank interface of the bolt terminates at or extend slightly beyond the combined dimension of the two fastened members, there is a risk that a nut threaded onto the bolt will not sufficiently compress the two members together. Where this situation occurs, there is a temptation of a maintenance worker or fabricator to continue rotating the nut/bolt combination beyond the thread/shank interface of the bolt in an effort to tighten the joint. This may result in the bolt/nut being partially or fully stripped, with subsequent weakening the joint.

Presently, fastener systems that require the maximum bolt shear strength and the maximum member bearing strength, such as aircraft and aerospace applications, tend to need washers or shims place beneath the bolt and nut head to locate the bolt shank at the desired depth in the joint. Where a washer cannot fit within the confines of the joint, a special washer must be fabricated or the bolt strength must be compromised. In other cases,

governing specifications that require the use of certain types and classes of bolts may limit the availability of thread length and grip length combinations. In these cases, the grip length of the bolt may exceed the joint thickness, in turn causing the bolt threads to terminate at the nut before the opposing members contact or before the appropriate compression can be applied to the joint members. The result can be normal and lateral movement between the members, which in turn reduces the quality of the joint.

Accordingly, it is one object of the invention to provide a general solution to this problem by allowing the thread/shank interface portion of the bolt to extend beyond the members to be joined to insure that the shank of the bolt is fully present at the shear plane between these members and that the appropriate amount of compression may be applied to the joint members. This is accomplished by providing additional thread between the bolt shank and the nut whereby the shank of the bolt is allowed to extend through the contact plane of the joined members, ensuring that the full shear strength of the bolt is attained and the appropriate amount of compression may be applied to the adjoining members.

SUMMARY OF THE INVENTION

A threaded nut assembly for conveniently being engaged to or disengaged from a bolt or screw is disclosed. The nut assembly, when engaged to the bolt, allocates additional thread to the bolt whereby continued rotation of the bolt along the bolt axis is enabled following abutment of the nut sleeve

against the thread/shank interface of the bolt. The nut assembly is constructed having an inner sleeve member of generally cylindrical shape whose outer surface is threaded and mateable to the inner threads of the outer member, and further having an inner threaded bore mateable with a bolt. With this construction, the bolt may be placed through an opening in the members to be joined and into the nut assembly on the opposite surface. An operator rotates the bolt, overcoming the friction between the inner threads of the sleeve and the bolt threads to a depth where the thread/shank interface on the bolt abuts the threads at the end of the sleeve. Continued application of force between the bolt and nut causes the nut to then begin rotating about the sleeve, thereby causing additional translation of the bolt and nut toward respective opposite surfaces.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows two views of the nut assembly embodiment, the first being a top view and the second being a side view in cross section along lines 1 – 1.

Figure 2 shows two views of a rotationally locked nut assembly embodiment, the first being a top view and the second being a side view in cross section along lines 2 – 2.

Figure 3 is a side cross sectional view of the nut assembly with a bolt and two planar surfaces included to show the mechanism in its staged or tightened position.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Fig. 1, a nut or similar fastener 1 is shown, nut 1 provided with an internal bore having threads 10 that would typically engage threads of a bolt. However, in the instant invention, a cylindrical sleeve-like member 2 is provided within nut 1, member 2 having external threads 12 that threadably engage internal threads 10 of nut 1. Member 2 is also provided with an internal bore provided with threads 14 adapted for threaded engagement with a bolt or other similar fastener. Threads 10, 12 and 14 are all cut in the same direction such that rotation direction of a bolt within the sleeve and rotation direction of the sleeve within the nut for advancement/retraction of the bolt/sleeve is the same direction. In other words, where a bolt is rotated clockwise to advance it into the sleeve, clockwise rotation of the sleeve will advance the sleeve into the nut. A temporary locking compound 3 may be provided between threads 10 and 12 in order to conveniently and temporarily lock the sleeve and nut together, as will be explained. Alternately, a mechanical clip or other device may be used to lock the sleeve and nut together. Such a clip may also provide a selected amount of tension between the sleeve and nut so that a predetermined amount of torque must be applied to the nut to effect relative rotation between the sleeve and nut. In another embodiment, the sleeve may be constructed slightly out-of-round or with other resistance against turning within the nut. This ensures that the sleeve will be tightened against the thread/shank interface of the bolt or other threaded member, with further rotation of the nut abutting a one of fastened members.

Such a construction would also serve as a locking mechanism to lock the nut assembly and bolt or other threaded article together.

Fig. 2 shows a particularly configured nut 1a having a flange 16 in turn provided with an opening 18. As in the embodiment of Fig. 1, a sleeve 2 having exterior threads 12 and interior threads 14 is threaded into threads 10a of nut 1a. In this embodiment, a rivet or other fastener 18 may be passed through opening 20 in order to clamp nut 1a coaxial to an opening 22 in a member 24. Such an arrangement would be used where a nut would otherwise be installed in an inaccessable location.

Fig. 3 illustrates operation of the instant invention. Here, a bolt 26 having a shank portion 28 and threaded portion 30 is shown extending through coaxial openings 32 and 34 of planar members 36 and 38, respectively. It is to be noted that a thread/shank interface 40 of bolt 26 extends beyond members 36 and 38 in order to fully position the shank portion of the bolt within openings 32 and 34, as is desirable where shear forces exist between members 36 and 38. However, and as stated above, such positioning of the shank makes it impossible for a nut to fully compress members 36 and 38 together due to the nut being blocked from further advancement by the elevation of thread/shank interface 40 above opening 34.

In Applicant's invention, as the nut/sleeve combination as shown in Fig. 1 is rotated about the threaded portion 30 of bolt 26, sleeve 2 initially makes contact with the thread/shank interface and is blocked from further rotation and advancement onto bolt 26. At that point, further application of

rotational force to the nut causes sleeve 2 to break free from the temporary locking compound 3, allowing the nut to rotate about the exterior threads 12 of sleeve 2 and advance beyond the thread/shank interface 40 of bolt 26. Upon contact with member 38, nut 1 may then be tightened to a specified torque, securing members 36 and 38 together.

While a specific embodiment is shown and described, it is to be understood that incidental changes may be made without departing from the scope of the invention. For instance, while sleeve 2 is shown as being generally shorter than the height of nut 1, a sleeve 2a, as shown in Fig. 4, could be the same height as the bore in the nut or greater so that a portion of the sleeve may extend beyond nut 1. In this instance, a second nut 2b (dashed lines) may be threaded on bolt 26 and secured against the extending end of sleeve 2a, firmly locking the entire assembly together and eliminating need for locking washers. Likewise, a nut 2c (dashed lines) may be threaded onto the extending portion of sleeve 2a to bear against nut 1, locking the assembly together. Either nut 2b or 2c could be used alone, or may be used together for additional locking strength.

After having thus described my invention and the manner of its use, it should be apparent that incidental changes may be made thereto that fairly fall within the scope of the following appended claims, wherein I claim: